

an operating system or other software. Processor **55** can be a single-chip processor or can be implemented with multiple components.

**[0079]** Computing device **42** also includes an input/output (I/O) controller **56** that is operatively coupled to processor **54**. I/O controller **56** may be integrated with processor **54** or it may be a separate component, as shown. I/O controller **56** is generally configured to control interactions with one or more I/O devices that can be coupled to computing device **42**, for example, input device **40**. I/O controller **56** generally operates by exchanging data between computing device **42** and I/O devices that desire to communicate with computing device **42**.

**[0080]** Computing device **42** also includes a display controller **58** that is operatively coupled to processor **54**. Display controller **58** may be integrated with processor **54** or it may be a separate component, as shown. Display controller **58** is configured to process display commands to produce text and graphics on a display screen **60**. By way of example, display screen **60** may be a monochrome display, color graphics adapter (CGA) display, enhanced graphics adapter (EGA) display, variable-graphics-array (VGA) display, super VGA display, liquid crystal display (LCD) (e.g., active matrix, passive matrix and the like), cathode ray tube (CRT), plasma displays, backlit light-emitting diode (LED) LCD displays, or the like.

**[0081]** In one embodiment (not shown), track pad **44** can comprise a glass surface functioning not only as a touch-sensitive surface, but also as a display screen; in this case display screen **60** shown in FIG. **13** would be integrated with the glass surface of the track pad **44**. This could be useful in computing devices (e.g., media players or mobile phones) having touch sensitive displays. An example of a media player having a touch sensitive display is the iPod Touch produced by Apple Inc. of Cupertino Calif. An example of a mobile phone having a touch sensitive display is the iPhone produced by Apple Inc. of Cupertino Calif.

**[0082]** In most cases, processor **54** together with an operating system operates to execute computer code and produce and use data. The computer code and data may reside within a program storage area **62** that is operatively coupled to processor **54**. Program storage area **62** generally provides a place to hold data that is being used by computing device **42**. By way of example, the program storage area may include Read-Only Memory (ROM), Random-Access Memory (RAM), hard disk drive and/or the like. The computer code and data could also reside on a removable program medium and loaded or installed onto the computing device when needed. In one embodiment, program storage area **62** is configured to store information for controlling how the tracking and button signals generated by input device **40** are used by computing device **42**.

**[0083]** FIG. **14** shows one embodiment of an input device, generally shown at **70**, comprising a track pad **72** connected to a frame **76**. Frame **76** may be a housing for a stand alone input device, or it may be a casing for another device which incorporates track pad **72**, for example a laptop computer, desktop computer, hand held media device, PDA, mobile phone, smart phone, etc. Track pad **72** includes various layers including an outer touch-sensitive track surface **74** for tracking finger movements. Track surface **74** may also provide a low friction cosmetic surface. In one embodiment, track pad **72** is based on capacitive sensing; therefore, it includes an electrode layer **80**, which, for example, may be implemented on a

PCB. In the case of capacitive sensing, track surface **74** is a dielectric material. A stiffener **84** is located below electrode layer **80**. Stiffener **84** is shown in FIG. **14** and FIG. **15**, but in some embodiments may be omitted. Stiffener **84** may be used to compensate for the inherent flexibility of electrode layer **80**. Electrode layer **80** responds to finger movements along to track surface **74** by sending signals to sensor **82**. In the case of capacitive sensing, electrode layer **80** registers changes in capacitance based on finger movements and sensor **82** is a capacitive sensor. In this way, track pad **72** incorporates a touch sensor arrangement. Sensor **82** is shown disposed on the bottom of electrode layer **80**, but it may be located elsewhere in other embodiments. If, as in the illustrated embodiment, sensor **82** is located on a movable part of track pad **72**, the input device may incorporate a flexible electrical connection (not shown) capable of moving with the system.

**[0084]** A movement indicator **78** is disposed on the bottom of track pad **72**. Movement indicator **78** may be widely varied, however, in this embodiment it takes the form of a mechanical switch, which is typically disposed between the track pad **72** and the frame **76**. In other embodiments, movement indicator **78** may be a sensor, for example an electrical sensor. Movement indicator **78** may be attached to frame **76** or to track pad **72**. In the illustrated embodiment, movement indicator **78** is attached to the bottom side of electrode layer **80**. By way of example, if electrode layer **80** is located on a PCB, movement indicator **78** may be located on the bottom of the PCB. In another example, movement indicator **78** may take the form of a tact switches and more particularly, may be an SMT dome switches (dome switch packaged for SMT).

**[0085]** Track pad **72** is shown in its neutral position in FIG. **14**, where movement sensor **78** is not in contact with frame **76**. When a user applies a downward pressure to track surface **74**, track pad **72** may move downward causing movement sensor **78** to register this change in position. In the illustrated embodiment, movement sensor **78** (a tact switch) would contact either frame **76**, or in this case set screw **88**. Set screw **88** may be manually adjusted to alter the distance between the neutral and activate positions. In one embodiment (not shown), set screw **88** may directly abut movement sensor **78** in the neutral position, such that there is no slack or pre-travel in the system. A flexure hinge **86** connects track pad **72** with frame **76**. Flexure hinge **86** is a resilient material that flexes when a force is applied, but exerts a restoring force so as to urge track pad **72** back towards the neutral position. In one embodiment, flexure hinge **86** may be thin spring steel.

**[0086]** As shown in FIG. **15**, flexure hinge **86** will flex when a user pushes down on track surface **74**. Flexure **86** also urges track pad **72** towards its neutral position, which in the illustrated embodiment shown in FIG. **14** is horizontal. In this way, a user can press down virtually anywhere on track surface **74** and cause a "pick," meaning that movement indicator **78** will register this depression. This is in contrast to prior track pads which incorporate separate track zones and pick zones. Being able to pick anywhere on track surface **74** will provide the user with a more intuitive and pleasurable interface. For example, a user may be able to generate tracking and button signals with a single finger without ever having to remove the finger from track surface **74**. In contrast, a user operating a track pad with separate track and pick zones may, for example, use a right hand for tracking and a left hand for picking, or a forefinger for tracking and thumb picking.

**[0087]** A shoulder **90**, which may be an extension of frame **76** or a discrete member, blocks track pad **72** from travelling